SCIENTIFIC SERIALS

THE *Journal of Mental Science*, April, 1876.—Reflex, automatic, and unconscious cerebration, a history and a criticism, by Thomas Laycock, M.D., is continued and completed in this number. The paper is very interesting. Dr. Laycock takes great pains, and is, we think, successful in making good his claim to priority over Dr. Carpenter in certain views of an advanced nature, which, if they are not already, will soon be entirely absorbed in others much more advanced.—Dr. John M. Diarmid writes in high praise of morphia in the treatment of insanity, when administered subcutaneously.—Dr. Daniel Huck Tuke gives an historical sketch of the past asylum movement in the United States, doing full justice to the enlightenment and humanity of American physicians, while recording the outstanding difference between them and their English brethren in the principle and practice of non-restraint.—A modest but suggestive paper on the use of analogy in the study and treatment of mental disease, is contributed by Dr. J. R. Gasquet.—Dr. P. Maury Deas describes a visit to the Insane Colony at Gheel, where the accumulating experience of a thousand years has produced an instinctive aptitude to manage the insane worth more in practice than the best of our consciously-formed systems.—Dr. Isaac makes some interesting observations on general paralysis.—"Arthur Schopenhauer: his Life and his Philosophy," by Helen Zimmern, is reviewed in a manner worthy the book and its subject.—The *Journal* contains other reviews, clinical notes and cases, news, &c.

Zeitschrift der Oesterreichischen Gesellschaft für Meteorologie, Feb. 1.—In this number appears the first part of a paper by Dr. W. Köppen, on the yearly periods of probability of rain in the northern hemisphere. It is accompanied by a valuable diagram of curves. He begins by calling attention to the value of the system on which his calculations are based, namely, the mere registration of the days of which rain falls in each locality. Considering that in our latitudes changes of vapour tension and of relative humidity do not concur, it is simpler than measuring the quantity of rain or snow. The probability of a downfall depends upon two conditions, the degree of relative humidity between, say 100 and 3,000 metres altitude, and the favourable or unfavourable circumstances for the formation of an ascending current, or, firstly, on the rate of decrease of temperature with height; secondly, on the slope of the ground towards the direction of the wind, while the quantity depends also on the quantity of vapour contained in a volume of air, and so, *cæteris paribus*, on the temperature. He then gives a detailed account of the authorities from whom he has derived his materials. The selected stations are well distributed over the greater part of the northern hemisphere, including the North Atlantic, and have most of them afforded records during more than ten years. As in his former writings on the subject, he represents graphically the means of groups of neighbouring stations having similar annual distribution of rainfall, but annexes a table showing the actual numbers for each station. The diagram exhibits the probability of rain in each month for each district.

Feb. 15.—In this number Dr. Köppen concludes his remarks on the yearly periods of probability of rain. The paper, which is illustrated by elaborate tables, contains much valuable information respecting the times of year at which rain is most and least probable in a great number of countries and districts of the northern hemisphere.

Gazzetta Chimica Italiana, Anno VI., 1876, Fascicolo I.—Synthesis of the sulpho-tannic acids, by Hugo Schiff. The author in this paper treats of phenol-sulphuric anhydride, trichlorhydroquinone-sulphuric acid, sulphopyrogallic acid, sulphotannic and pentacetosulphotannic acids, the sulpho-acids of phoroglucin, &c.—On the elasticity of metals at different temperatures, by G. Pisati. In this paper the author investigates the elasticity of iron and steel, arriving at the following formula:—

$$K = \frac{P.L_0\,(1 + \alpha t)}{\pi r_0^2\;(+\alpha t)^2.\,l} = \frac{P.L_0}{\pi r_0^2\,.\,l}\,.\,\frac{1}{1 + \alpha t}$$

where K is the modulus of elasticity of stretching force, P the weight which acting on the length of wire L, produces the lengthening l, α is the co-efficient of linear expansion.—Modification of the process for the extraction of alkaloids in poisoning of the viscera, by F. Selmi.—On a method of detecting traces of phosphoric acid in toxicological researches, by F. Selmi.—On the use of phyllocyanine as a reagent, by Guido Pellagri.—Action of iodide of allyl and zinc on oxalic ether, by E. Paterno and P. Spica.—Chemical researches upon twelve coloured solids found at Pompeii.—The remainder of the part is occupied by extracts from foreign journals.

SOCIETIES AND ACADEMIES

LONDON

Royal Society, May 4.—"On the Origin of Windings of Rivers in Alluvial Plains, with Remarks on the Flow of Water round Bends in Pipes," by Prof. James Thomson, LL.D., F.R.S.E. Communicated by Prof. Sir William Thomson, F.R.S.

In respect to the origin of the windings of rivers flowing through alluvial plains, people have usually taken the rough notion that when there is a bend in any way commenced, the water just rushes out against the outer bank of the river at the bend, and so washes that bank away, and allows deposition to

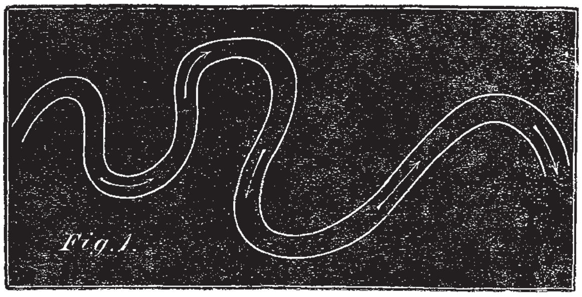

Fig. 1.

occur on the inner bank, and thus makes the sinuosity increase. But in this they overlook the hydraulic principle, not generally known, that a stream flowing along a straight channel and thence into a curve, must flow with a diminished velocity along the outer bank, and an increased velocity along the inner bank, if we regard the flow as that of a perfect fluid. In view of this principle, the question arose to me some years ago, *Why does not the inner bank wear away more than the outer one?* We know by general experience and observation that in fact the outer one does wear away, and that deposits are often made along the inner one. *How does this arise?*

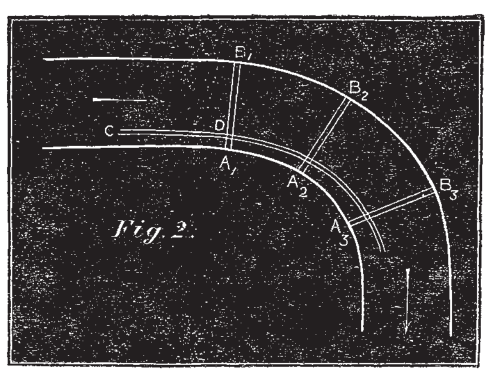

Fig. 2.

The explanation occurred to me in the year 1872, mainly as follows:—For any lines of particles taken across the stream at different places, as A_1B_1, A_2B_2, &c., in Fig. 2, and which may be designated in general as AB, if the line be level, the water pressure must be increasing from A to B, on account of the centrifugal force of the particles composing that line or bar of water; or, what comes to the same thing, the water-surface of the river will have a transverse inclination rising from A to B. The water in any stream line CDE[1] at or near the surface, or in any case not close to the bottom, and flowing nearly along the inner bank, will not accelerate itself in entering on the bend, except in con-

[1] This, although here conveniently spoken of as a stream-line, is not to be supposed as having really a steady flow. It may be conceived of as an average stream-line in a place where the flow is disturbed with eddies or by the surrounding water commingling with it.

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sequence of its having a *fall of free-level* in passing along that stream-line.[1]

But the layer of water along the bottom, being by friction much retarded, has much less centrifugal force in any bar of its particles extending across the river; and consequently it will flow sidewise along the bottom towards the inner bank, and will, part of it at least, rise up between the stream-line and the inner bank, and will protect the bank from the rapid scour of that stream-line and of other adjacent parts of the rapidly flowing current; and as the sand and mud in motion at bottom are carried in that bottom layer, they will be in some degree brought in to that inner bank, and may have a tendency to be deposited there.

On the other hand, along the outer bank there will be a general tendency to descent of surface-water which will have a high velocity, not having been much impeded by friction; and this will wear away the bank and carry the worn substance in a great degree down to the bottom, where, as explained before, there will be a general prevailing tendency towards the inner bank.

Now further, it seems that even from the very beginning of the curve forward there will thus be a considerable protection to the inner bank. Because a surface stream-line C D, or one not close to the bottom, flowing along the bank which in the bend becomes the inner bank, will tend to depart from the inner bank at D, the commencement of the bend, and to go forward along D E, or by some such course, leaving the space G between it and the bank to be supplied by slower moving water which has been moving along the bottom of the river perhaps by some such oblique path as the dotted line F G.

It is further to be observed that ordinarily or very frequently there will be detritus travelling down stream along the bottom

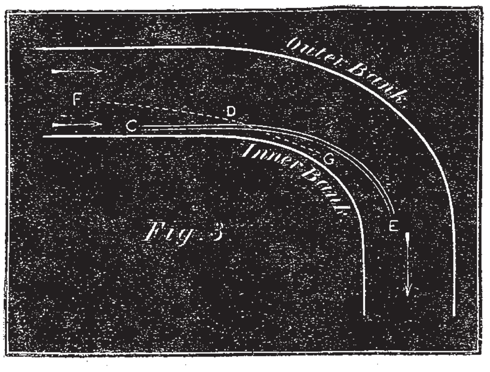

Fig. 3

and seeking for resting places, because the cases here specially under consideration are only such as occur in alluvial plains; and in regions of that kind there is ordinarily[2] on the average more deposition than erosion. This consideration explains that we need not have to seek for the material for deposition on the inner bank in the material worn away from the outer bank of the same bend of the river. The material worn from the outer bank may have to travel a long distance down stream before finding an inner bank of a bend on which to deposit itself. And now it seems very clear that in the gravel, sand, and mud carried down stream along the bottom of the river to the place where the bend commences, there is an ample supply of detritus for deposition on the inner bank of the river even at the earliest points in the curve which will offer any resting place. It is especially worthy of notice that the oblique flow along the bottom towards the inner bank begins even up stream from the bend, as already explained, and as shown by the dotted line F G in Fig. 3. The transverse movement comprised in this oblique flow is instigated by the abatement of pressure, or lowering of free-level, in the water along the inner bank produced by centrifugal force in the way already explained.

It may now be remarked that the considerations which have in the present paper been adduced in respect to the mode of flow of water round a bend of a river, by bringing under notice, conjointly, the lowering of free-level of the water at and near the inner bank, and the raising of free-level of the water at and near the outer bank relatively to the free-level of the water at middle of the stream, and the effect of retardation of velocity in the layer flowing along the bed of the channel in diminishing the centrifugal force in the layer retarded, and so causing that retarded water, and also frictionally retarded water, even in a straight channel of approach to the bend, to flow obliquely towards the inner bank, tends very materially to elucidate the subject of the mode of flow of water round bends in pipes, and the manner in which bends cause augmentation of frictional resistance in pipes, a subject in regard to which I believe no good exposition has hitherto been published in any printed books or papers; but about which various views, mostly crude and misleading, have been published from time to time, and are now often repeated, but which, almost entirely, ought to be at once rejected.

[1] It must be here explained that, by the *free-level* for any particle, is to be understood the level of an atmospheric end of a column, or of any bar, straight or curved, of particles of statical water, having one end situated at the level of the particle, and having at that end the same pressure as the particle has, and having the other end, consisting of a level surface of water, freely exposed to the atmosphere, or else having otherwise atmospheric pressure there; or briefly we may say that the *free-level* for any particle of water is the level of the atmospheric end of its *pressure column*, or of an equivalent ideal pressure-column.

[2] That is to say, except when by geological changes the causes which have been producing the alluvial plane have become extinct, and erosion by the river has come to predominate over deposition.

Mathematical Society, May 11.—Prof. H. J. S. Smith, F.R.S., president, in the chair.—Dr. Logan was elected a member of the Society.—Mr. Tucker communicated a paper by Mr. S. A. Renshaw, on the inscription of a polygon in a conic section, subject to the condition that each of its sides shall pass through a given point by the aid of the generating circle of the conic. The inscription of a polygon in a circle, subject to the like condition, has been accomplished by several eminent geometers, in a remarkably easy manner by the late Mr. Swale. The object of Mr. Renshaw's paper is to show how, by an easy transformation, effected by means of the generating circle, the construction of the problem in the circle can be rendered available to the resolution of the same problem in the conic sections. The author draws figures exhibiting the inscription of a pentagon in an ellipse, and of a quadrilateral in a hyperbola. Mr. Renshaw also extends some other properties (for the circle) given by Mr. Swale in the *Liverpool Apollonius* (p. 45) to the conic sections.—Prof. Cayley then spoke on the representation of imaginary quantities by an (n, n) correspondence. The Chairman and Dr. Hirst spoke on the subject of this paper. Prof. Cayley having taken the chair, the President communicated two notes. The first was on a theorem relating to the Pellian equation. Let D be any integral number, let T and U be the least integral numbers which satisfy the Pellian equation $T^2 - DU^2 = 1$; and let $\Omega_1, \Omega_2, \Omega_3, \ldots \Omega_{2n}$ be the period of complete quotients of the form $\frac{\sqrt{D} + Q}{P}$ which is obtained in the development of the root of any quadratic equation of determinant D in a continued fraction. The equality

$$\Omega_1 \times \Omega_2 \times \ldots \times \Omega_{2n} = T + U\sqrt{D}$$

was established in the note, and an expression for the number of non-equivalent quadratic forms of determinant D was deduced from it. The second note was on the value of a certain arithmetical determinant. Let (m, n) represent the greatest common divisor of m and n; and let $\psi(m)$ represent the number of numbers prime to m, and not surpassing m; the equality

$$\Sigma \pm (1, 1)\,(2, 2)\,\ldots\,(m, m) = \psi(1)\,\psi(2)\,\ldots\,\psi(m)$$

was established in the note, and several consequences deduced from it.

Zoological Society, May 16.—Dr. A. Günther, F.R.S., vice-president, in the chair. —Dr. P. Comrie exhibited and made remarks on the zoological specimens collected by him during the survey of the south-eastern coast of New Guinea by H.M.S. *Basilisk*.—Dr. Günther exhibited and made remarks on a collection of Mammals from the coast of Borneo, opposite to Labuan. Among these were especially noticed a young example of a Monkey (*Macacus melanotis*) of which the exact habitat was previously unknown, and a new species of *Tupaia*, proposed to be called *T. minor*.—Dr. Günther also read an extract from a letter recently received from Commander Cookson, R.N., stating that he was bringing home from the Galapagos Islands a living pair of the large Land-tortoise, of Albemarle Island. Commander Cookson stated that the male of this pair weighed 270 lbs., the female 117 lbs.—Mr. Sclater exhibited the skin of a rare Pacific Parrot (*Coriphilus kuhli*), which had been obtained by Dr. T. Hale Streets, U.S. Navy, at Washington Island, of the Palmyra group, and had been sent to him for examination

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by Dr. E. Coues.—Prof. Martin Duncan, F.R.S., read the second portion of a memoir on the *Madreporaria* dredged up during the expedition of H.M.S. *Porcupine*.—Prof. Duncan also read descriptions of new littoral and deep-sea corals from the Atlantic Ocean, the Antilles, the New Zealand and Japanese Seas, and the Persian Gulf.—Prof. W. H. Flower, F.R.S., read a paper on some cranial and dental characters of the existing species of Rhinoceroses. This paper contained the result of the examination of fifty-three skulls of Rhinoceroses contained in the Museum of the College of Surgeons and the British Museum, and described the principal characteristics of the five forms under which they could all be arranged, viz.: 1. *Rhinoceros unicornis*, Linn. (including *R. stenocephalus*, Gray); 2. *Rhinoceros sondaicus*, Cuv. (including *R. floweri* and *R. nasalis* of Gray); 3. *Ceratorhinus sumatrensis*, Cuv. (including *C. niger* Gray); 4. *Atelodus bicornis*, Linn. (including *A. keitlon*, A. Smith; 5. *Atelodus simus*, Burchell. It was also shown that the skull of a Rhinoceros lately received at the British Museum from Borneo, was that of a two-horned species not distinguishable from *C. sumatrensis*.—A communication was read from Dr. Julius von Haast, F.R.S., containing some further notes on *Oulodon grayi*, a new genus of Ziphioid Whales, from the New Zealand Seas.

Geneva

Physical and Natural History Society, February 3.—Prof. Marignac gave a *résumé* of researches on the specific heats of saline solutions. This work, the result of a long series of experiments, does not lead to any general law enabling us to infer the specific heat of the solution from that of the constituent elements, bases, or acids. This paper is published in the *Archives des Sciences*.—M. Théod. Turrettini, who has to make frequent visits to the boring of the St. Gothard tunnel, gave an account of a phenomenon which is frequently produced during the progress of the work in the granitic mass of the mountain. When the rock is shaken by the explosion of a mine, the reports resulting from the explosion are not the only immediate ones produced. Afterwards, and at unequal intervals, other spontaneous explosions are produced, at considerable distances from the mine-hole, of which the cause is unknown, and which cause numerous accidents to the workmen. The phenomenon is new, and it appears to indicate in the very substance of the granite, a species of tension inherent in its formation, and which, agitated at one point, is transmitted to a distance so as suddenly to disengage large fragments of material. It may be compared with the experiment daily made by the quarrymen who work the erratic blocks in the valleys of the Alps, to obtain building materials. In order to obtain them they use wedges of wood which they drive into holes pierced for the purpose, and which, being wetted, cause by their expansion the disjunction of the granitic masses. This disjunction is not produced by gradual fissures as in the case of mill-stones, for example. It is always accompanied by an explosion more or less violent, and the two disjoined surfaces cannot again be exactly fitted to each other. There is deformation of the material, leading to the presumption of a state of latent tension existing in the constitution of the rock itself, and which a point hitherto quite mysterious, may throw light on the mode of formation of these ancient rocks.

Paris

Academy of Sciences, May 22.—Vice-Admiral Paris in the chair.—The following papers were read:—Second note on theoretical and experimental determinations of the ratio of the two specific heats in perfect gases whose molecules are monatomic, by M. Yvon Villarceau.—M. Vulpian was elected Member in the Section of Medicine and Surgery, in room of the late M. Andral.—On photographic images obtained at the foci of astronomical telescopes, by M. Angot. The dimension of the image increases considerably with duration of exposure and intensity of the light. The phenomenon is the same, whether the collodion be dry or moist; also when the intensity of light is varied, the time of exposure remaining constant. M. Angot was led to reject the idea of a travelling (*cheminement*) of the photographic action. He deduces the effects from the ordinary theory of diffraction.—Action of organic acids on the tungstates of soda and potash, by M. Lefort.—On the physical properties of water supply, by M. Gerardin. He distinguishes two types—blue water and green water—represented at Paris by the Vanne and the Seine respectively. The blue is changed into green in many ways, but most powerfully by organic matter in decomposition.—On the lead contained in certain platinum points used in lightning-conductors, by M. de Luca. Two such points were fused by lightning at the Vesuvius Observatory in March; they contained 10 to 12 per cent. of lead. Platinum points for lightning rods should have at least a density = 21.—On the antiseptic properties of borax, by M. Larrey.—On the preparation of a mixture containing cyanide of potassium, for destruction of phylloxera, by M. Milius.—On instrumental diffraction, by M. André. He draws some inferences from the fact that two observers with telescopes of different apertures do not perceive the moon's limb at the same instant; the telescope with the smaller aperture will show it a little sooner than the other.—Modifications in electric piles, rendering their construction easier and more economical, by M. Onimus. He substitutes parchment paper for the porous vessel. Thus a simple and good sulphate of copper pile may be made by wrapping a zinc cylinder in parchment paper, winding spirally a copper wire round this and immersing the whole in a sulphate of copper solution.—New experiments on the flexibility of ice, by M. Bianconi. Ice expelled by constant pressure (by an iron plate *e.g.*) rises in a crest about the compressing body. It has, manifestly, compressibility or plasticity, but slow and very limited.—On nitrides and carbides of niobium and tantalum, by M. Joley.—Normal pyrotartaric acid, by M. Reboul.—On electrolysis of derivatives of aniline, phenol, naphtylamine, and arthraquinone, by M. Goppelsroeder.—On the fixation of atmospheric nitrogen by mould, by M. Schloesing. M. Deherain's experiments to prove that gaseous nitrogen can be fixed in a state of combination by various organic matters, were repeated (with certain precautions) by the author, but with negative results.—On the nature of the mineral substances assimilated by champignone, by M. Cailletet. The mycelium takes from the soil almost the whole of the alkalies and phosphoric acid present. The ashes of champignons are simpler than those of chlorophyll plants. Silicon and iron, important elements in the latter, are absent in the former; which are also poor in lime and magnesia. The author explains how fairy circles are formed.—On the anatomy of the musical apparatus of the grasshopper, by M. Carlet. He corrects, in some points, what has hitherto been taught about this organ.—On a new species of psorospermia (*Lythocystis Schneideri*) parasite of *Echinocardium cordatum*, by M. Giard.—On the deposits of quaternary fossils in Mayenne, by M. Gaudry. This district, which has not yet attracted much of the attention of geologists, is one of the most interesting in France for study of quaternary palæontology.—The Akkas, or dwarfs, of the interior of Africa, by M. Mariette. Dwarfs play an important part in the religions of the ancient Egyptians, and it is probable the latter knew the country of the Niams-Niams.—Traumatic tetanus treated successfully by intravenous injections of chloral, note by M. Oré.—On the erosions which must be attributed to action of diluvial waters, by M. Robert. There are, on hill-sides such as those in the valley of the Oise, two sorts of erosions, the one very old, reaching back to the cataclysm of geologists, the other more recent, and still in the process of being formed.

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